Volume 31 July, 1945 *Number 7*

Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

Lubrication of
Rubber Plant
Machinery

PUBLISHED BY
THE TEXAS COMPANY
TEXACO PETROLEUM PRODUCTS

The synthetic rubber program is a demonstration of the capabilities of organized American industry, condensing into two war years the development of a new and basic product from laboratory processes to a complete new industry.

The Texas Company has played a large part in this program by helping to design, build and operate the butadiene plant of the Neches Butane Products Company at Port Neches, Texas. Now operating at a rate of 165,000 tons per year (50% above rated capacity) it is producing enough butadiene for about 40,000,000 passenger car tires per year. This plant was designed, built and operated without profit or management fee as a petroleum industry contribution to the war effort.

The magnitude of the Neches project may be judged by its consumption of 50,000,000 pounds of steam and 300,000,000 gallons of cooling water per day. The plant area is 314 acres.

LUBRICATION

A TECHNICAL PUBLICATION DEVOTED TO THE SELECTION AND USE OF LUBRICANTS

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In the May issue of Lubrication we published the first half of an article on "Greases — Part I — their Manufacture." The second half was to have appeared in this issue, but we regret that production difficulties have forced us to delay its publication. The conclusion of our May article will appear in our August issue.

Lubrication of Rubber Plant Machinery

THE rubber plant involves an assembly of heavy duty machinery. From the bale cutters, washers and crackers which are required for preliminary handling of crude rubber, all the way through the rest of the plant there are machines designed specifically to withstand severe shock loads, high temperatures and overload service.

Some of the operations require comparatively simple machine assemblies especially when the stock is subjected to roll treatment. For others, as in mixing, plasticating and pelletizing, special machinery has been developed which handles the stock more rapidly, more economically and with greater assurance of stock uniformity by the time it reaches the forming stage.

AUTOMATIC LUBRICATION

The trend towards automatic lubrication in the rubber industry has been activated by the need to reduce dependence on the human element, and to

SYNTHETIC RUBBER AND PETROLEUM

WHEN Michael Faraday discovered in 1826 that natural rubber was a polymer made up of hydrocarbons of eight atoms of hydrogen and five carbon atoms, he laid the ground work for a program of organic chemical research which has contributed vitally to the preservation of democracy. But for Faraday, his contemporaries and their successors, synthetic rubber might still be but an idea. Instead it has become the basis of a new phase of the rubber industry which will have a lasting effect upon our economic life.

Synthetic rubber in the raw can be one of several types. Buna-S, the one which has proved applicable to so many fields where formerly natural rubber was used, can be produced from petroleum's butadiene gas. The chemist polymerizes some three parts of this gas with one part of styrene (which may also be a petroleum product) to produce the raw material which is subsequently compounded and processed to make it applicable to home, industry and transportation.

Buna-N also is derived from Butadiene.

Another petroleum gas — isobutylene — which results from cracking petroleum, is the source of Butyl rubber.

Rubber interests us from a lubrication point of view, since the machinery required for mixing, compounding, processing and forming requires careful lubrication.

promote more effective operation with less maintenance. When bearings are fitted with individual oil or grease cups, regular inspection and refilling is necessary. This brings in the human element. If the attendant is conscientious and educated to the vital need for adequate lubrication, but little difficulty is experienced. If, however, he is careless and misses a grease cup or if an oil cup runs dry, bearing trouble may result.

The manufacturers have studied this problem and their solution in the form of automatic lubrication is noteworthy. Centralized grease and oil lubrication has become very popular on the mixer; bath lubrication is standard on the plasticator and extruding machines. The mechanical force feed lubricator is used to excellent advantage elsewhere around the mill and virtually all of the gear sets are dip, bath or splash lubricated.

The necessity for cleanliness in the operation of rubber machinery is highly important. It is very essential to prevent petroleum contamination of pigments, or products such as linseed oil, which may be used to soften uncured raw stocks, for petroleum lubricants tend to destroy certain of the desired properties in rubber, particularly if they are allowed to come in contact with the product already compounded. Possibility of dust contamination from the compounds must also be considered.

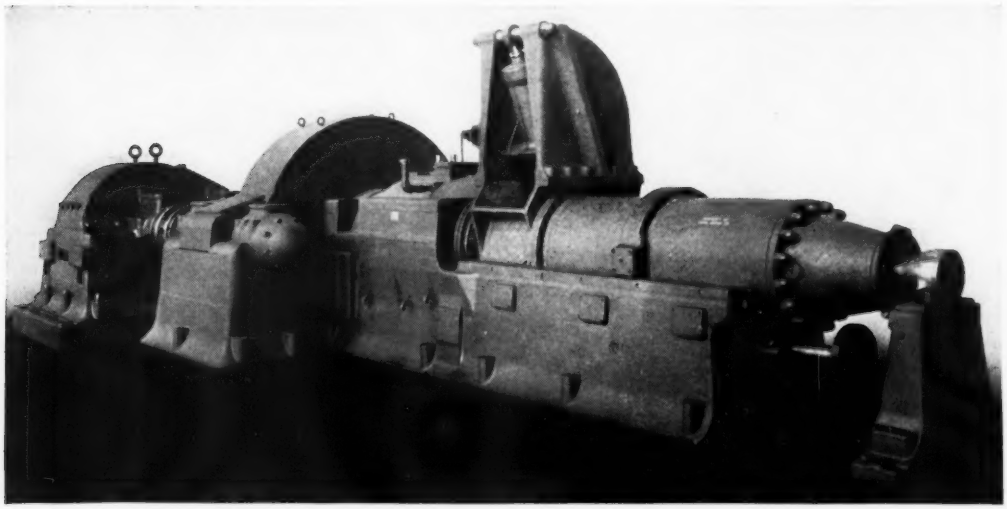
THE PLASTICATOR

The Gordon Plasticator takes the place of roll mills for working raw rubber stock to break it down and improve its plasticity. This must be done to both natural and synthetic stocks. The Plasticator consists essentially of a specially designed rotor or screw enclosed in a cylinder equipped with a suitable extruding head and with circuits for heating or cooling of the various parts. Drive is by electric motor through herringbone reduction gears which are fully enclosed and run in an oil bath.

Designing for Lubrication

Roller bearings, a specially designed thrust bearing, and the drive and reduction gears are the salient parts on the Plasticator which must be lubricated. The bearing housings have been given special attention by the designers, to provide suitable seals which will prevent leakage of lubricant.

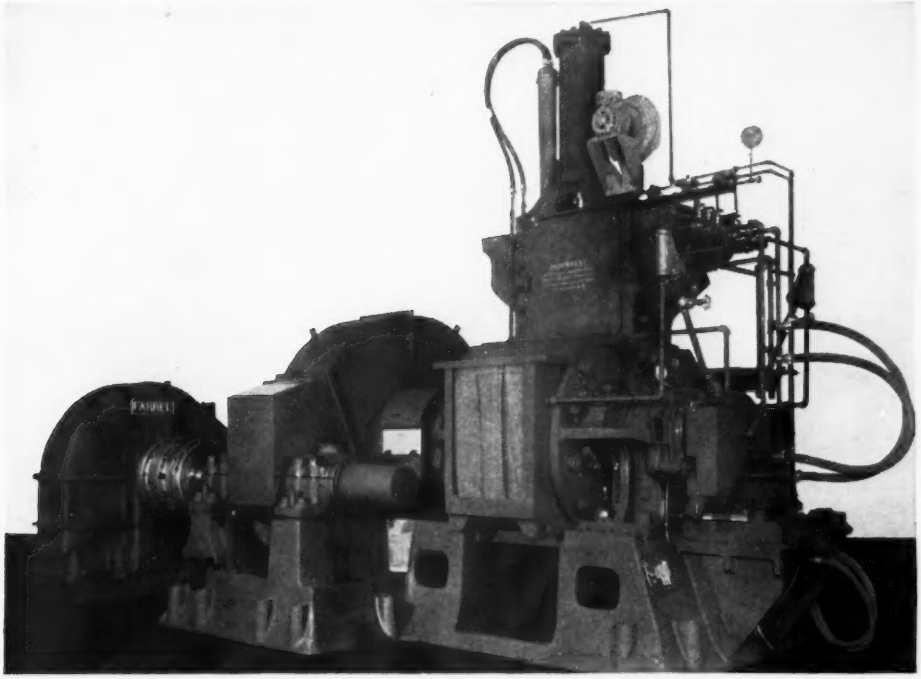
Lubrication of the thrust bearing is very important. Here the thrust loads developed as the stock is extruded, are absorbed. Lubrication plays an important part in assisting the thrust bearing to take up these loads. Accordingly this bearing (along with the adjacent rotor bearing) is lubricated independently of the other parts.



Gordon 20" Plasticator

The lubricant must be comparatively heavy for this service, i.e., having a viscosity of from 150 to 200 seconds Saybolt Universal at 210° F. A compounded oil is recommended by the manufacturer with the thought that the fatty oil component gives the necessary increase in adhesiveness to the lubricating film to carry the loads satisfactorily and reduce wear on the bearing parts. These parts operate continuously in a bath of this oil.

The herringbone reduction gears which are part of the Plasticator drive are fully enclosed and run in a bath of oil which provides splash lubrication. These gears are designed for heavy duty. Along



Size 11 Banbury Mixer, spray cooled type.

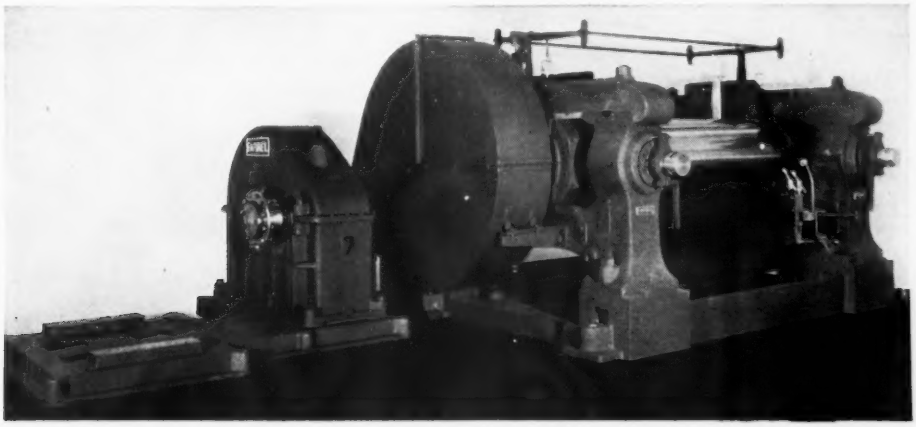
with the gear and pinion bearings they are generally lubricated effectually by a well refined straight mineral oil of from 140 to 165 seconds Saybolt Universal viscosity at 210° F.

Under some operating conditions, however, a mild E.P. type of gear oil as discussed on page 78 under Extreme Pressure Lubricants for Gears is suggested as imparting a greater factor of safety to the lubricating film.

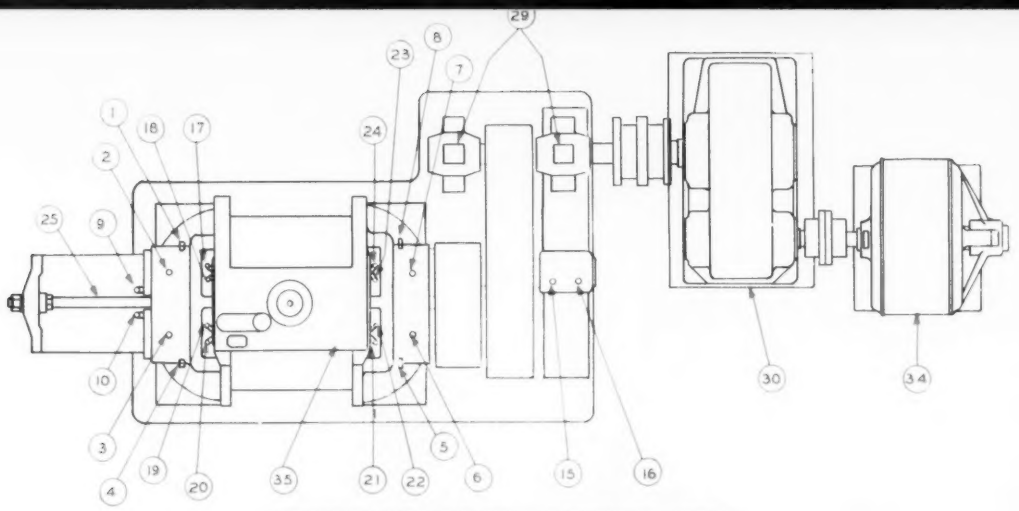
PELLET RUBBER

Pellet rubber paved the way for automatic handling of rubber stock by conveyors. In the pelletizer rubber stock is extruded through a suitable perforated head and cut to size by revolving knives.

Lubrication of the Pelletizer must be just as carefully considered as lubrication of the Plasticator. The operating conditions are very much the same. The loads, however, are somewhat less. The design

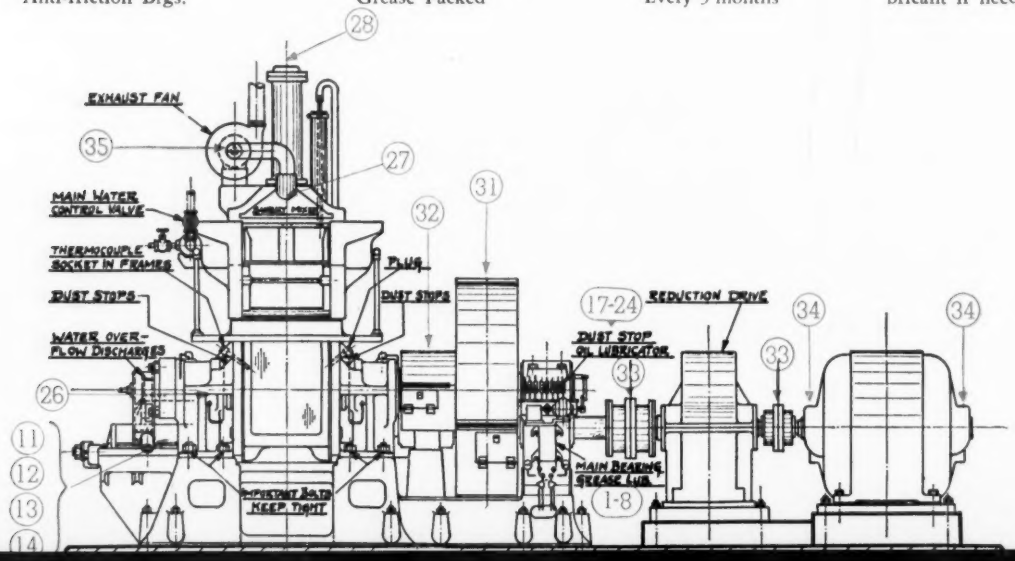


26" x 84" heavy duty rubber mill with individual motor drive.



LUBRICATION GUIDE — BANBURY MIXER

Parts to Be Lubricated	Method of Application	When to Lubricate	Remarks
Main Bearings #1 to 8 inclusive Thrust Collars #9 & 10	Compression Grease Cup	Every 2 to 4 hours	Be sure that fresh grease shows at both ends of brgs. and points applied.
Discharge Door Rails #11-12-13-14 Drive Outboard Brg. #15 & 16	F.F. Grease Lubricator	Periodical Intervals Set by timer.	
Dust Stop Rings #17 to 24 incl.	Mechanical F.F. Lubricator.	Periodical intervals Set by stroke of lub.	Be sure oil shows at contact surfaces and keep lub. tank full of oil specified.
Discharge Door Piston Rod #25	Hand Oiled	Daily	
Discharge Door Piston Pack'g. #26			
Leather Packing	Hand Oiled	Weekly	
Piston Ring	Hand Oiled	Weekly	
Floating Wt. Piston Rod #27	Hand Oiled	Twice Daily	
Floating Wt. Piston Packing #28			
Leather Packing	Hand Oiled	Weekly	
Drive Pinion Shaft Bearings #29			
Pillow Block	Collar-Oiling	Daily	Examine periodically and change lubricant if needed.
Anti-friction Brgs.	Grease Packed	Every 3 months	
Reduction Gear Drive #30			
Anti-friction Brgs.	Splash	Keep to proper oil gauge level	Examine periodically and change lubricant if needed.
Sleeve Brgs.	Splash		
Bull Gear & Pinion #31 Connecting Gears #32	Slush Pan	Keep oil level so that teeth dip into oil	Examine daily and change lubricant if needed.
Gearflex Couplings #33	Bath	Keep Proper Oil level	Inspect Weekly.
Main Drive Motor Brgs. #34			
Sleeve Bearings	Ring Oiled	Daily	Examine periodically and change lubricant if needed.
Anti-friction Brg.	Grease Packed	Every 3 months	
Exhaust Fan Motor Brgs. #35			
Sleeve Bearings	Ring or wick pack'g.	Daily	Examine periodically and change lubricant if needed.
Anti-friction Brgs.	Grease Packed	Every 3 months	



of the thrust bearing oiling system is interesting. As mentioned in our discussion of the Plasticator, it runs in a bath of oil. See Figure on page 75.

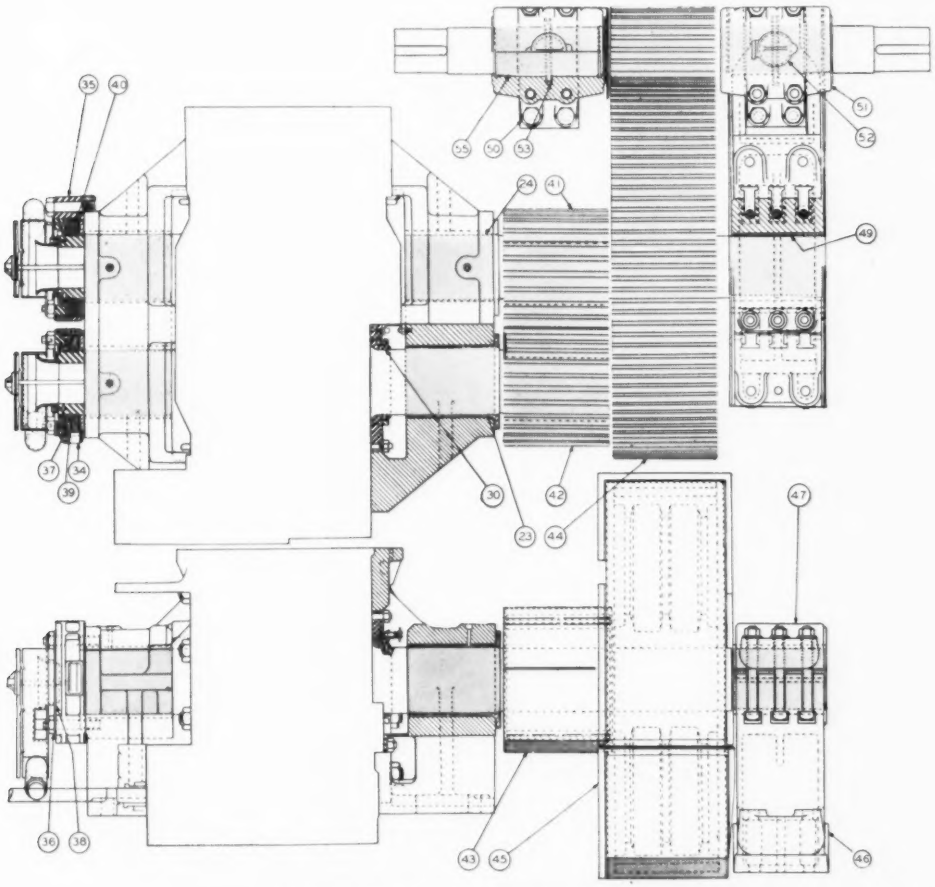
MIXING AND MILLING

The art of mixing which was perfected for the handling of natural rubber has more recently been extended to synthetic rubber and a wide variety of plastics. In the early days of the rubber industry, mixing was done in open roll mills; then a lot of handling was necessary, and labor, power and operating costs were comparatively high.

When machinery for internal mixing was developed, the advantages were so outstanding that it virtually revolutionized that operation in the rubber industry. No wonder internal mixing has become so widely adopted. Later when synthetic rubber and plastics were found to be so vital to our war-time activities and industrial needs, the Banbury mixer became even more popular than ever.

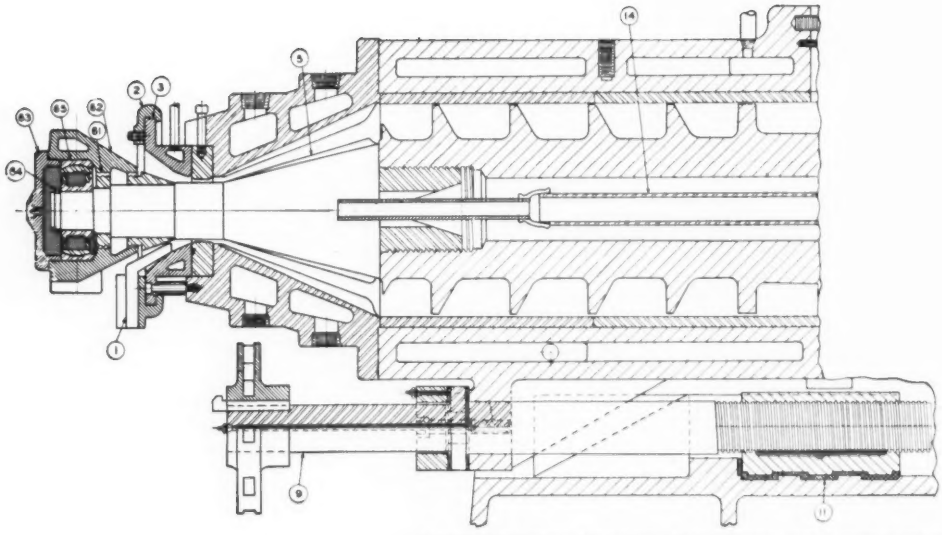
Mixer Details

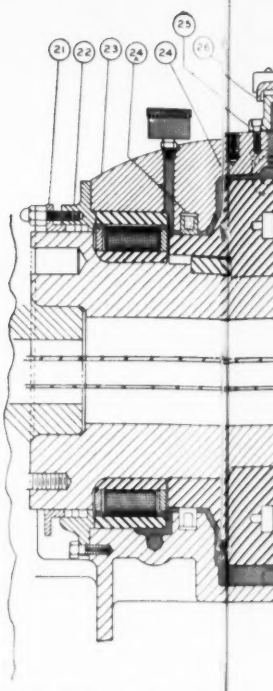
The Banbury mixer consists essentially of an enclosed trough or mixing chamber in which operate two mixing rotors or blades, a hopper into which the materials are fed, and a sliding door in the bottom through which the mixed batch is discharged. The blades of the rotors are formed in an



PARTS LIST — NO. 11 BANBURY MIXER

Part No.	Name of Part	Part No.	Name of Part	Part No.	Name of Part
23	Short Rotor	39	Thrust Ring	47	Outboard Bearing Cap
24	Long Rotor	40	Thrust Collar	49	Outboard Bearing Bushing
30	Rotor Collar	41	Rotor Connecting Pinion	50	Light Type R.O. Pedestal Base
34	Thrust Ring Collar-R.H.	42	Rotor Connecting Gear	51	Light Type R.O. Pedestal Cap
35	Thrust Ring Collar-L.H.	43	Connecting Gear Guard	52	Pedestal Cap Oil Cover
36	Thrust Ring Collar Bolt	44	Drive Gear	53	Pedestal Cap Oil Ring
37	Thrust Ring Nut	45	Drive Gear Guard	55	Drive Pinion Shaft
38	Thrust Ring Cover	46	Outboard Bearing		



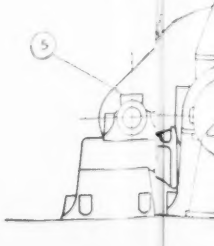


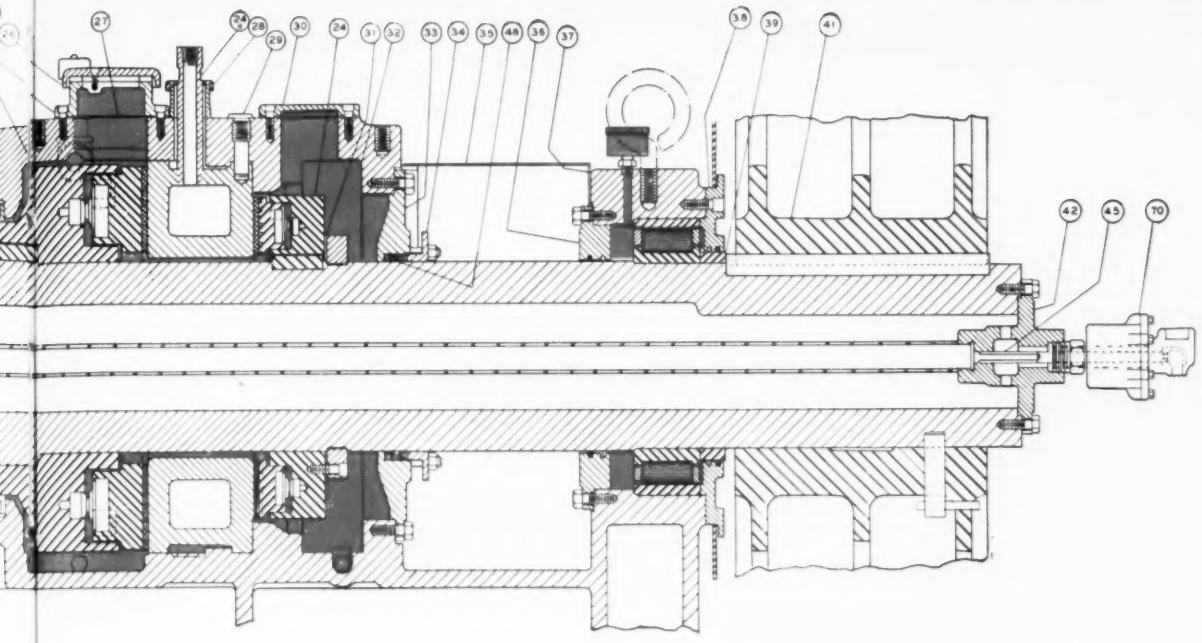
LUBRICATION CHART GORDON 20" STRAIGHT LINE PLASTICATOR

Point No.	No. of Lubricators	Type of Lubricator	Service Period	Parts Lubricated
1	1	Oil Reservoir	Maintain level (between bottom of gauge & groove "F")	Kingsbury Thru Bearing
2	1	Grease Cup	One filling when new: Filled automatically from (1) afterwards.	Forward Radial Roller Bearing
3	1	Grease Cup	Once daily.	Rear Radial Roller Bearing
4	1	Oil Reservoir	Maintain level so that gear dips.	Bull Gear and Pinion
5	2	Oil Reservoir	Maintain level so that collar dips.	Pinion shaft bearings
6	1	Zerk Fitting	Once daily.	Outboard bearing
7	1	Zerk Fitting	One or more times daily.	Adjusting screw thrust collar
8	9	Zerk Fitting	According to frequency of adjustment.	Cylinders & Gib
9	1	Spring Grease Cup		Adjusting screw & nut
10	2	Zerk Fitting	Once Daily	Feed Cylinder Ways
11	1	Zerk Fitting	Once Daily	Feed Cylinder Lath

PARTS LIST — GORDON 20" STRAIGHT LINE PLASTICATOR

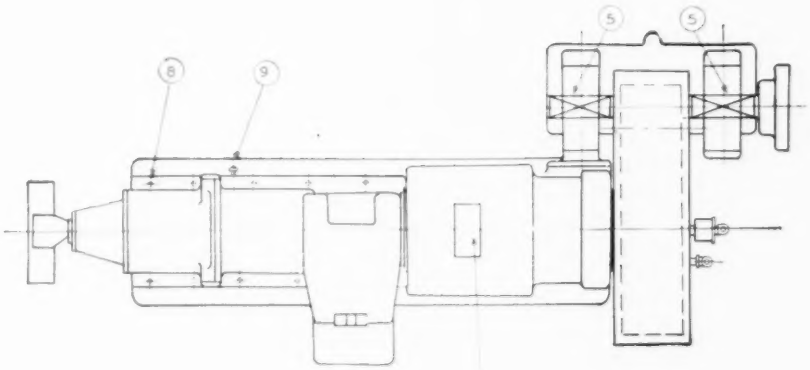
Part No.	Name of Part	Part No.	Name of Part
1	Slitting Knife	32	Split Ring Key
2	Knife Ring	33	Thrust Bearing Cover
3	Steam Heated Die	34	Thrust Bearing Gland
5	Cone	35	Dust Cover
9	Adjusting Screw	36	Grease Retaining Ring
11	Adjusting Screw Nut	37	Rear Bearing Cap
14	Rotor Pipe Assembly	38	Rear Bearing Cover
21	Front Bearing Gland	39	Inner Race Ring
22	Front Bearing Cover	41	Drive Gear
23	Main Bearing Cap	42	Stuffing Box Flange
24	Kingsbury Thrust Brg.	45	Inner Pipe
24A	Ring (By Kingsbury)	47	Front Stuffing Box Packing
24B	Bushing (By Kingsbury)	48	Thrust Stuffing Box Packing
25	Oil Screen Base	61	Rear Ring
26	Oil Screen Cover	62	Bearing Housing
27	Oil Screen	63	Housing Cover
28	Bushing Cover	64	Snap Ring
29	Thrust Bearing Dowel	65	Bearing MCS5719
30	Inspection Cover	70	Flexible Joint
31	Thrust Bearing Shim		

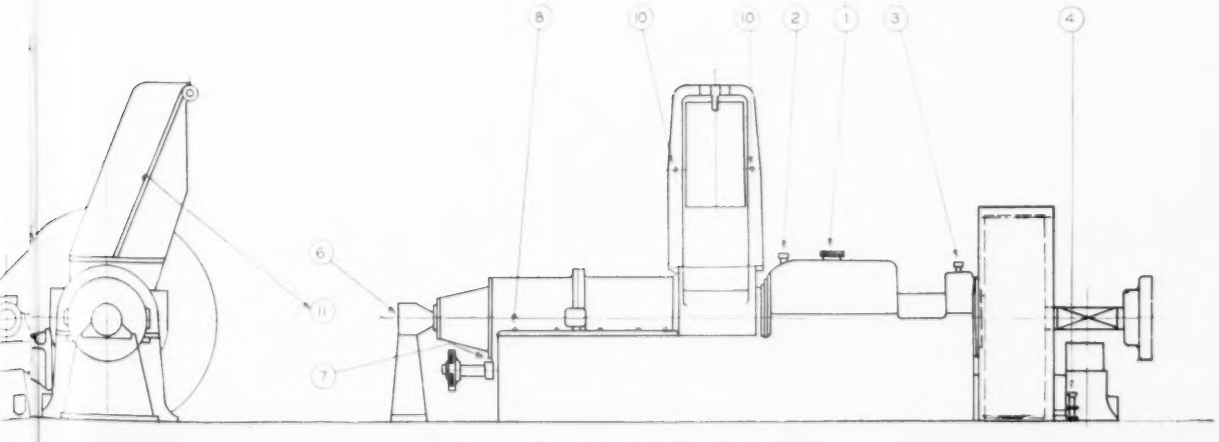




R

BRICATED	POINT NO.
hru	1
dial oiller	2
Rolle	3
nd Inion	4
bea ngs	5
arin	6
rew hrust	7
Gib	8
rew nut	9
er Ways	10
er Inch	11





interrupted spiral and the rotors are operated at slightly different speeds to apply a smearing action between the component particles. Water sprays are installed around the body of the machine for cooling. The rotors also have cooling elements. End-thrust adjustments are provided to absorb the slight axial forces developed by the spiral blades and to prevent stock from working out through the housings. These adjustments are designed for close fitting and follow-up as wear occurs.

A two-speed motor is optional so that the machine can be operated not only at standard speed but at a somewhat higher speed where desirable. The temperature of working is controlled by the amount of cooling water which is circulated through the cored rotors and sprayed against the side walls.

The Operating Mechanisms

The operating mechanisms and parts to be lubricated on a Banbury mixer are shown in detail on the accompanying lubrication guide — (Page 70). Note also the table of recommended procedure. Lubrication is a matter of following this procedure, using lubricants of a type which have been proved to be suitable.

Mills

Mills are used for breaking-down rubber, grinding rubber and scrap materials, warming stock in preparation for the calender and tubing machine, sheeting from the Banbury mixer, etc. They are also still used for mixing rubber and compounding ingredients, but to a lesser extent since the Banbury mixer came into such universal use.

Slow speeds and heavy pressures prevail in the operation of mills, accordingly the lubricants used for the gears and bearings must be of comparatively heavy body, and particularly adapted to take shock loads.

Variations of mills are used as crackers, washers and refiners. These machines are similar in design to mills, though they vary as to size of the rolls, finish of the roll surfaces, speed and other characteristics. The rolls are shorter in relation to the diameter, and in crackers and washers one or both are corrugated. Refiner rolls are ground smooth and are of different diameters to increase the surface speed differential. In refiners the rolls are run close together under heavy pressure and at much higher speed to obtain the greatest possible refining action and output.

HEAVY DUTY BEARINGS

In the rubber industry these may be of the plain sleeve type, or they may be roller bearings. The Banbury mixer, for example, uses plain bearings to carry the journals of the rotors. These bearings are protected by dust stops to prevent leakage of ingredients into the bearings. Dust stops are accessible for adjustment. Automatic lubrication gives added protection to all these parts.

On the plasticator, in contrast, straight roller bearings carry the rotor. Calenders, mills and other roll machines employ suitably designed sleeve bearings. In brief, the type of bearing has been worked out by the builders based on their experience with actual operating requirements. They approached lubrication in the same manner.

Sleeve Bearing Requirements

Application of a plain or sleeve type bearing to rubber mill machinery must be studied from several angles:

a — The type of bearing metal.
b — The prevailing loads.
c — The operating temperatures.
d — The manner of grooving.
e — The means of lubrication.

The first three are relatively stable. The designer has certain bearing metals — babbitts or bronzes — which he can use. He selects these according to his experience with the expected loads and the operating temperatures.

When it comes to grooving, however, there are many different patterns which he can follow. All have their relative merits. Some have definitely bad features. As he is dealing with heavy loads which may be unevenly distributed or applied suddenly as shock loads, he must consider the pressure area of his plain bearings. Here is where these shock loads will cause trouble if there is not sufficient lubrication. Grooving of any plain bearing must be planned so as to lead a continuous supply of lubricant — either grease or oil — to the pressure area. If the grooving leads the lubricant away from the pressure area, starved lubrication will result.

A rotating journal acts as a lubricant pump as it turns in its bearing. Grooving aids definitely in maintaining this pumping action. Amazing as it may seem, very high pressures can be developed in the lubricating system in this manner, sufficient to keep an adequate oil film flowing continually over the high pressure area of the bearing to prevent metallic contact with the journal, and wear. Pressure build-up in the lubricating film can be accentuated by gradually reducing the depth of the oil groove as it approaches the pressure area.

The Method of Lubrication

Given any sleeve or plain bearing installation, the manner of lubricant application can be varied. Oil cups, grease cups, centralized grease lubrication, splash or bath lubrication are all applicable to

rubber mill machinery plain bearings. Pressure grease lubrication is being favored on more recent installations for example, using a centralized system for distribution. This enables re-lubrication under more constant pressure, prevents the possibility of abrasive matter getting in with the grease and assures that the bearings will be regularly lubricated.

Regular Lubrication Is Most Important

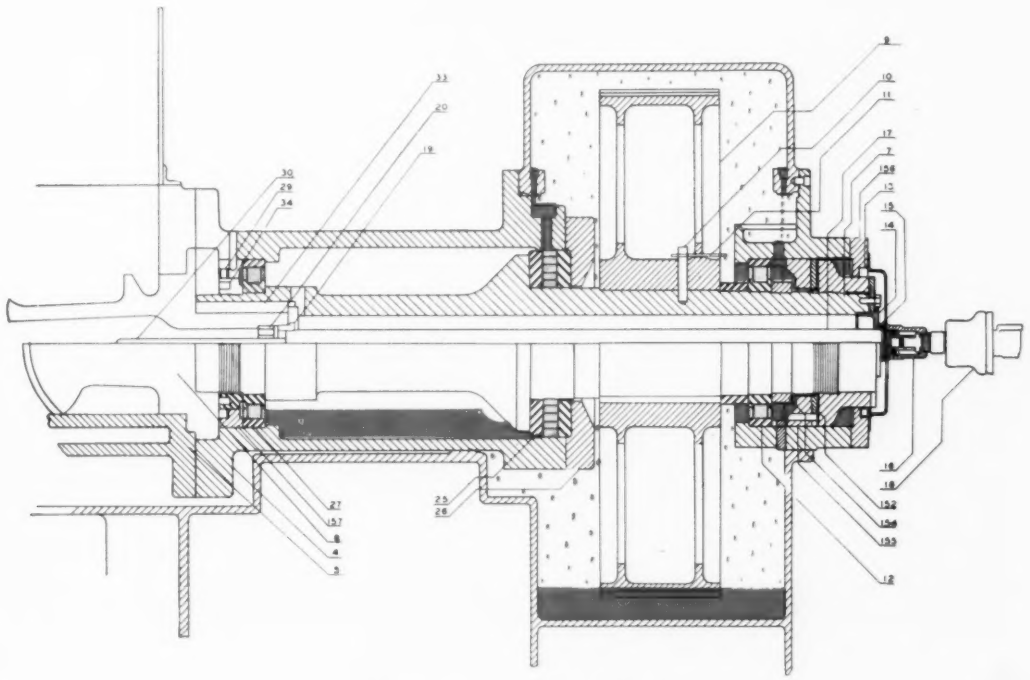
This came to be realized when the rubber industry went into high speed production and continuous operation. No longer could they afford to rely entirely on the human element. It was too easy to forget to turn down a grease cup, or miss a pressure fitting. Too often when these ran dry, bearing trouble developed and damage progressed sufficiently before it was noticed, to require cutting the machine out of line for repair.

Regular attention to the lubrication schedule is most important. Every operator and mechanic should be drilled with this thought in mind. Nor does the installation of a centralized lubricating system relieve him of this responsibility. Such a system cannot manufacture lubricant — it must be kept properly filled. The same goes for splash or bath-oiled bearings and gears. An alarm control can be installed to warn when lubrication stops. Then the machine automatically shuts down.

Roller Bearings

The designer of rubber mill machinery does not have to worry about grooving when he is about to apply a roller bearing.

The heavy duty roller bearing may be built to a number of designs. These include cylindrical, barrel-shaped, tapered and cylindrical-helical rollers, carried in suitable retainers which keep them in proper position with respect to the inner and outer races.



PARTS LIST — 12″ PELLETIZER

Part No.	Name of Part	Part No.	Name of Part	Part No.	Name of Part
4	Rear Cylinder	14	Pipe Support	29	Garlock Oil Seal
5	Hopper Cylinder	15	Pipe Lock	30	Inner Pipe
7	Drive Spindle	16	Reducing Coupling	33	Key
8	Feed Screw	17	Outer Pipe	34	Locknut
9	Drive Gear	18	Johnson Joint	152	Thrust Bearing
10	Pin	19	Reducing Bushing	153	Thrust Ring
11	Pin	20	Inner Pipe Support	154	Bearing Lock Ring
12	End Plate Bearing-Rollway	25	Thrust Collar Bearing-Rollway	156	End Cover
13	Garlock Oil Seal	26	Thrust Bearing Cover	157	Forward Bearing Collar
		27	Forward Bearing-Rollway		

Contact Area

Alignment is most important in roller bearing operation. The actual contact area of a roller bearing is rectangular. This must be maintained without deviation, for skewing of a roller may throw the entire bearing out of line, to result in uneven load distribution and wear. In other words, the axes of the rollers must be in the same plane as the axis of the rotating shaft. Proper guiding has been found to be the most effective way to keep the rollers from skewing; this is a function of the guide flange. Obviously it becomes more difficult as rollers are increased in ratio of length to diameter.

While one objective is attained, another is aggravated by the sliding motion which is developed between the ends of the rollers and the end plates or race flanges. Here steel-to-steel contact exists, presenting a condition which requires continuous renewal of the lubricating film.

Function of the Lubricant

In roller bearing service the lubricant performs a four-fold duty, viz:

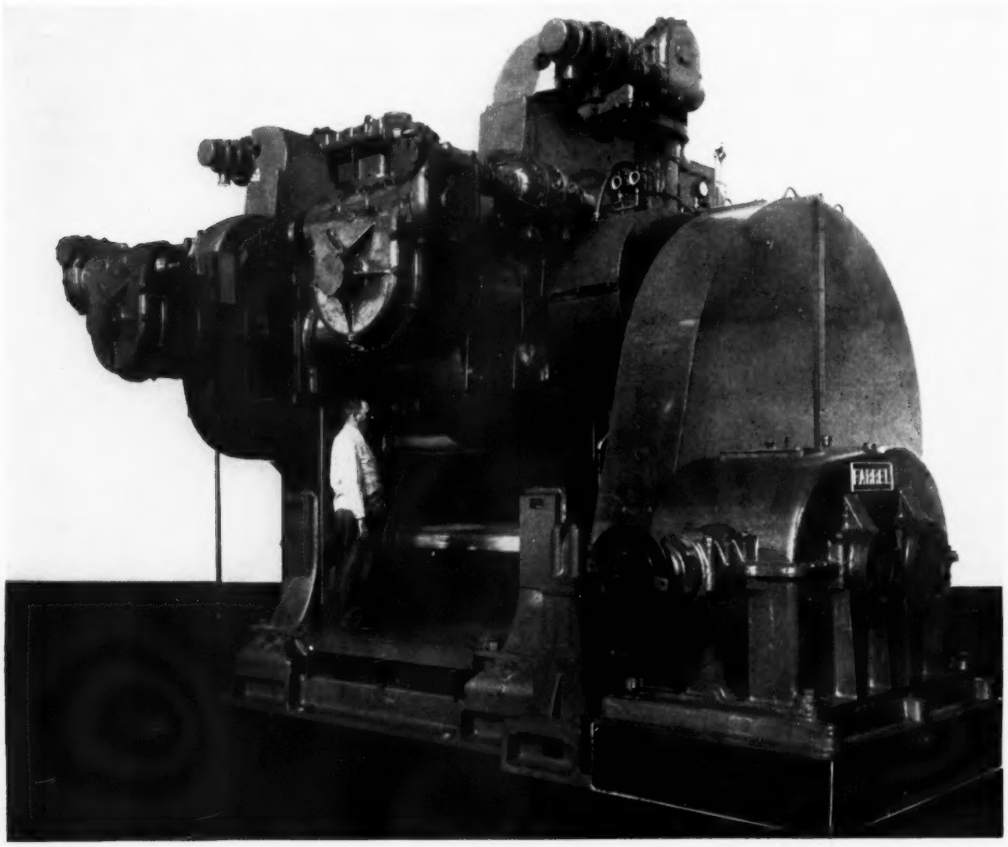
(1) It protects the surfaces of the bearing elements against corrosion.

(2) It assists the seal in preventing water or dirt from coming into actual contact with the bearing surfaces.

(3) It serves as a conductor of heat, to aid in bearing cooling.

(4) It functions as a lubricant to enable free rolling of the rollers, and sliding between the rubbing surfaces of the shoulders and rollers.

A free flowing lubricant at the prevailing operating temperatures will most nearly lead to the attainment of these objectives. By this term is meant a grease or oil which will "train" readily with the rollers, yet channel sufficiently so that actual churning does not occur. Excessive churning will build up the torque through internal resistances within the lubricant itself. This frictional effect leads to heat development which may easily build up the bearing temperature beyond the cooling ability of the lubricant, at times even beyond the cooling ability of the external cooling system.



Four-roll calender with individual motor adjustment for each screw.

Cleanliness Reduces Bearing Wear

We have spoken of the seal as an adjunct to cleanliness. Obviously, it is important to keep out abrasive foreign matter. But it is also quite as important to use clean, dirt-free lubricants, otherwise the purpose of the seal is offset.

Abrasive particles in a grease, especially, will cause rough rolling of the bearing. When this occurs in a freshly lubricated element, it signifies abrasion. At first this may not be noticeable. But abrasion is going on just the same, until, dependent upon the amount of dirt, the speed and the size of the bearing, loose rolling or chattering will develop. At the same time, the heat at the contact points may be so high as to assist in oxidation breakdown of the lubricant. Then gums and lacquers form. The only recourse is thorough cleaning, drying and relubrication of the bearing parts before wear has occurred to such an extent as to require bearing replacement.

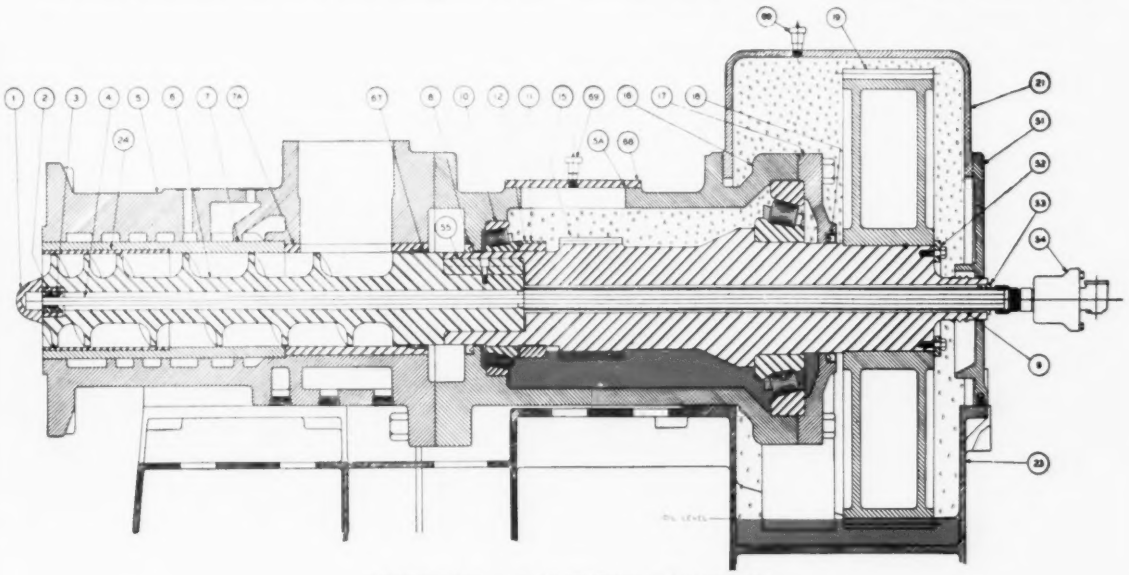
Methods of Lubrication

Pressure grease lubrication by positive delivery of measured quantities of grease at periodic intervals has been actively studied and a variety of systems has been perfected. All have been designed to assure the exclusion of non-lubricating foreign matter, economy of lubricants, minimum hazard in handling and filling and remote control. These advantages prevail in any installation involving heavy-duty roller bearings. The manner in which the pressure is applied, however, will depend upon the type of service and the number of bearings.

Bearings designed for oil lubrication must be equipped with especially prepared seals, the duty of which is to prevent oil loss through leakage; also, to keep out water or contaminating foreign matter. They may be served with measured quantities of oil or provided for oil circulation. Furthermore, the bearing housing can be so designed that there is a free flow of oil through the entire elements with but little chance for churning. Finally, continuous reconditioning of the oil supply keeps it in good condition and free from non-lubricating materials which might otherwise affect bearing performance.

EXTREME PRESSURE LUBRICANTS

Lately there has been a decided trend towards favoring E.P. lubricants for rubber machinery gears and certain bearings. The higher speeds and heavier loads on the machines and continuous operation contributed to this trend. Before the advent of the



PARTS LIST — 10″ TUBING MACHINE

Part No.	Name of Part	Part No.	Name of Part	Part No.	Name of Part
1	Cone	9	Outer Pipe	23	Base
2	Textolite Bushing	10	Timken Cone	24	Cylinder Liner
3	Pipe Support	11	Lock Nut	51	End Plate
4	Rotor Pipe	12	Lock Washer	52	Gear Ring
5	Forward Cylinder	15	Drive Spindle	53	Outer Pipe Support
5A	Rear Cylinder	16	Timken Bearing	54	Johnson Joint
6	Feed Screw	17	Cylinder Head	55	Feed Screw Key
7	Cylinder Liner Forward	18	Klosure Ring	67	Rear Bushing
7A	Cylinder Liner Rear	19	Drive Gear	68	Rear Cylinder Cover
8	Klosure Ring	21	Gear Cover	69	Breather

E.P. type of gear lubricants bull gears of the spur type were lubricated with a well refined straight mineral oil. The prevalence of shock loading was recognized, but unless loading developed into an overload, straight mineral oils of around the 140 S.A.E. viscosity range (120 to 200 sec. Saybolt Univ. at 210° F.) were normally satisfactory. Today, when heavy continuous loads prevail the mild E.P. type of non-corrosive gear lubricant is favored. This load carrying capacity is highly advisable to take care of shock loads; it is obtained by blending high quality mineral oils with carefully selected lead soaps, in such a manner as to produce compounds of pronounced stability and adhesiveness.

Other Outstanding Characteristics

In addition to load-carrying capacity this type of lubricant has other outstanding characteristics:

1. *Performance*
   It will not lose its extreme pressure characteristics during service.
2. *Non-Separation*
   It does not separate in storage or in service and can be centrifuged without loss of lead soap. Laboratory tests equivalent to 40 passes through a mill centrifuge show no loss in lead compound.
3. *Exceptional Adhesive Properties*
   It is adhesive to gears even if submerged in water.
4. *Non-Corrosive*
   It is not corrosive to steel, copper, bronze or cadmium-nickel bearings.
5. *Good Miscibility*
   Any heavier grade can be cut back with a lighter grade of the same type of oil if lower viscosity is desired for low temperature service. Mixing should be done around 150° F. outside of the lubricating system if possible.

CALENDERS

Finishing of rubber begins at the calender. Up to this point the procedure involves working of ingredients to produce a stock suitable for finishing. The calender is a form of rolling mill which takes this stock and reduces it to sheets of desired thickness. Rubber coating of fabrics is another operation performed by the calender.

Heat is necessary to maintain the plasticity of the product. Consequently the calender rolls are steam heated. Considerable pressure also is exerted on the bearings, which means that the bearings may have to be water-cooled; otherwise they might become so hot as to cause the bearing metal to soften.

Temperature control and bearing metal stability present definite problems to the designer. The former is fixed by the temperatures of the steam to be used, the inlet temperature of the cooling water and the rate of water circulation. Bearing metal stability is dictated by the melting point of the bearing metal (which is a measure of its resistance to heat) and how effectively it can be lubricated.

Older types of calender bearings were lubricated by compression grease cups, grease pockets in the top bearing caps or by heavy oil. The modern way is to use a mechanical force feed lubricator or provide for flood lubrication of the journal boxes with a circulating pump, oil cooler and oil sump tank.

The viscosity of the oil required for calender bearings depends upon the journal temperature. Up to 140° F. an oil of from 75 to 125 seconds Saybolt Universal viscosity at 210° F. is suggested. Above this temperature, up to the usual maximum of 350° F., heavier oils are desirable up to a maximum viscosity of 330 seconds at 210° F. For grease-lubricated bearings a heavy duty grease compounded with a fairly high viscosity straight mineral oil is usual. For the other parts of such machines, follow the builders' lubrication guides as to oil viscosities or types of grease.

THE TUBING MACHINE

In contrast with the calender which rolls out rubber and rubber-coated products in sheet form the tubing machine produces the finished product by extrusion through a die. A variation of this machine is used for refining rubber stock by forcing it through a strainer head.

Splash or bath lubrication is incorporated in most of these machines today. The same gear lubricant used on similar gears elsewhere in the plant may also be used here. The shaft bearings are normally of the anti-friction type. They are usually oil-bath lubricated. A compounded heavy bodied (steam cylinder type) oil of from 140 to 165 S.S.U. viscosity at 210° F. is desirable for the spindle radial bearings and the thrust bearing.

MOLDED RUBBER

When molded rubber goods are mentioned, many people imagine that the rubber is melted and poured into molds. This is not the case. When the rubber has been properly compounded it is cut into pieces of the approximate shape of the finished product and of sufficient volume to fill the mold. The molds are then pressed between the platens of a hydraulic press where they are subjected to temperatures sufficiently high to cure or vulcanize them in the mold. Hollow molded rubber goods are made hollow by compressed air. Samples of this class of work are rubber balls, dolls and toy animals.

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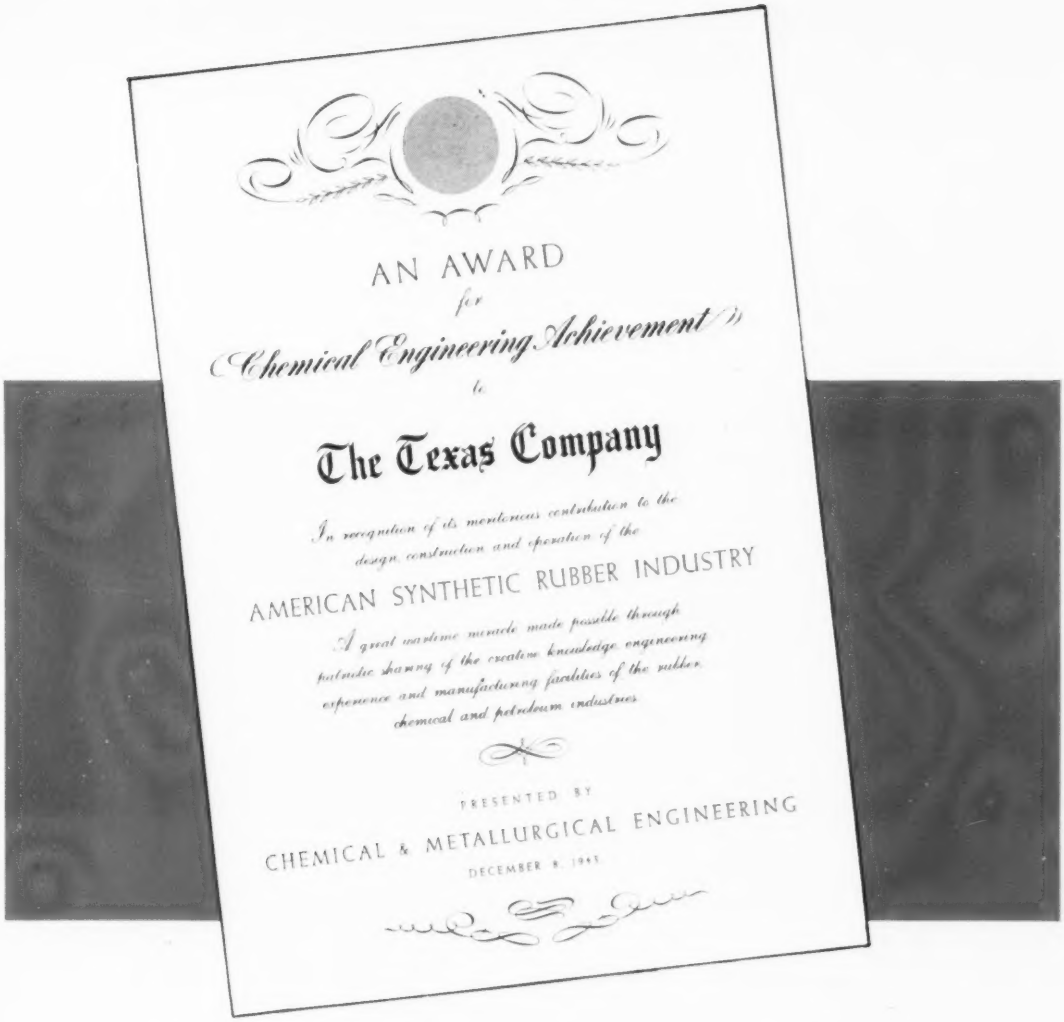
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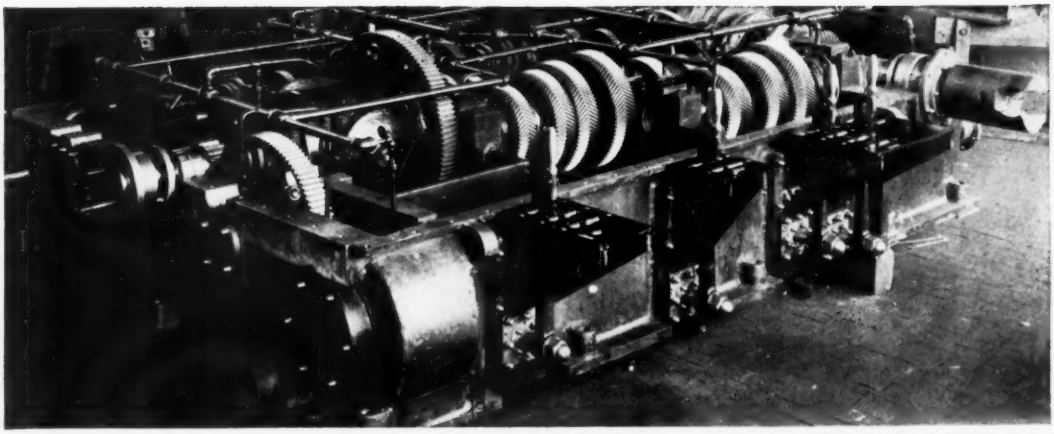
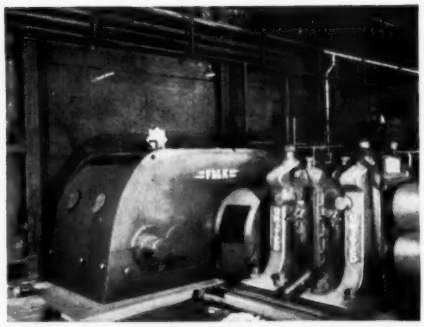


"SHEAR" NECESSITY



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